

What is claimed is:

- 1 1. A method comprising:
2 detecting, using magnetic resonance imaging, regional
3 neural activity in a subject undergoing magnetic resonance
4 imaging based on transient magnetic fields induced by the
5 regional neural activity; and
6 spatially and temporally localizing the regional
7 neural activity using at least a portion of the detected
8 transient magnetic fields.
- 1 2. The method of claim 1, wherein the magnetic
2 resonance imaging comprises applying an asymmetric pulse
3 sequence to the subject.
- 1 3. The method of claim 2, wherein the asymmetric
2 pulse sequence comprises a gradient-echo echo-planar image
3 pulse sequence.
- 1 4. The method of claim 3, wherein the asymmetric
2 pulse sequence comprises a repetition time of between
3 approximately 40 and 10,000 milliseconds, an echo time of
4 between approximately 10 and 200 milliseconds, and a flip
5 angle of between approximately 10 and 180 degrees.

1 5. The method of claim 1, wherein the detecting
2 comprises measuring magnetic resonance imaging signal
3 magnitude changes.

1 6. The method of claim 1, further comprising
2 stimulating the subject with a hemodynamically neutral
3 stimulation.

1 7. The method of claim 6, wherein the
2 hemodynamically neutral stimulation comprises providing
3 rapid stimuli to the subject.

1 8. The method of claim 7, further comprising causing
2 the subject to perform a motor activity in response to the
3 rapid stimuli.

1 9. The method of claim 1, further comprising
2 performing a second nervous system measurement technique to
3 conjoin with the magnetic resonance imaging.

1 10. The method of claim 9, wherein the second nervous
2 system measurement technique measures at least one of
3 cerebral hemodynamic, metabolic, and neural activity.

1 11. The method of claim 1, further comprising
2 detecting intrinsic rhythms of a nervous system of the
3 subject using the regional neural activity.

1 12. The method of claim 1, further comprising
2 diagnosing a disorder of a nervous system of the subject
3 using the regional neural activity.

1 13. The method of claim 1, further comprising
2 analyzing a drug effect on a nervous system of the subject
3 using the regional neural activity.

1 14. A method comprising:
2 performing magnetic resonance imaging on a subject;
3 and
4 directly mapping electromagnetic activity of the
5 subject via the magnetic resonance imaging.

1 15. The method of claim 14, wherein the magnetic
2 resonance imaging comprises applying an asymmetric pulse
3 sequence to the subject.

1 16. The method of claim 15, wherein the asymmetric
2 pulse sequence comprises a gradient-echo echo-planar image
3 pulse sequence.

1 17. The method of claim 14, further comprising
2 measuring magnetic resonance imaging signal magnitude
3 changes.

1 18. The method of claim 14, further comprising
2 stimulating the subject with a hemodynamically neutral
3 stimulation.

1 19. The method of claim 14, further comprising
2 performing a second nervous system measurement technique to
3 conjoin with the magnetic resonance imaging.

1 20. The method of claim 14, further comprising
2 detecting intrinsic rhythms of a nervous system of the
3 subject via the electromagnetic activity.

1 21. The method of claim 14, further comprising
2 diagnosing a disorder of a nervous system of the subject
3 based on the electromagnetic activity.

1 22. The method of claim 14, further comprising
2 measuring latency of the electromagnetic activity.

1 23. An article comprising a computer readable medium
2 containing instructions that if executed, enable a system
3 to:

4 detect, using magnetic resonance imaging, regional
5 neural activity in a subject undergoing magnetic resonance
6 imaging based on transient magnetic fields induced by the
7 regional neural activity; and
8 spatially and temporally localize the regional neural
9 activity using at least a portion of the detected transient
10 magnetic fields.

1 24. The article of claim 23, further comprising
2 instructions that if executed enable the system to apply an
3 asymmetric pulse sequence to the subject.

1 25. The article of claim 23, further comprising
2 instructions that if executed enable the system to measure
3 magnetic resonance imaging signal magnitude changes.

1 26. A system comprising:
2 a magnetic resonance imaging scanner having a
3 plurality of magnets to generate a magnetic field around a
4 subject; and
5 a controller coupled to the magnetic resonance imaging
6 scanner to detect a magnitude of magnetic resonance signals
7 representing a neuronal magnetic field.

1 27. The system of claim 26, wherein the plurality of
2 magnets comprises a main magnet and a gradient magnet.

1 28. The system of claim 26, wherein the controller is
2 further adapted to directly map electromagnetic activity of
3 the subject via the magnitude of the magnetic resonance
4 signals.

1 29. The system of claim 28, wherein the map comprises
2 a spatial and temporal localization of neuronal activity of
3 the subject.

1 30. The system of claim 26, further comprising a
2 second controller coupled to the magnetic resonance imaging
3 scanner to provide an asymmetric pulse sequence to the
4 magnetic resonance imaging scanner.

1 31. The system of claim 26, further comprising a
2 stimulus generator to provide a stimulus to the subject.

1 32. The system of claim 31, further comprising a
2 measurement device to measure a response of the subject to
3 the stimulus.

1 33. The system of claim 28, wherein the controller is
2 adapted to measure latency of the electromagnetic activity.

1 34. An article comprising a computer readable medium
2 containing instructions that if executed, enable a system
3 to:

4 receive magnitude resonance signals from a subject of
5 a magnetic resonance imaging system; and

6 process the magnitude resonance signals to directly
7 map neuronal activity of the subject.

1 35. The article of claim 34, further comprising
2 instructions that if executed enable the system to localize
3 the neuronal activity spatially and temporally.

1 36. The article of claim 34, further comprising
2 instructions that if executed enable the system to generate
3 an image based on the neuronal activity.